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In cooperation with the Johnson County Stormwater Management Program

# Water Quality of Streams in Johnson County, Kansas, 2002–07

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http://ks.water.usgs.gov/Kansas/studies/qw/joco

## Background

Rapid population growth and urbanization in Johnson County, Kansas, has affected stream quality. Urbanization alters stream hydrology, shape, chemistry, and biology. Streams are important for human and environmental health, water supply, recreation, and aesthetic value.

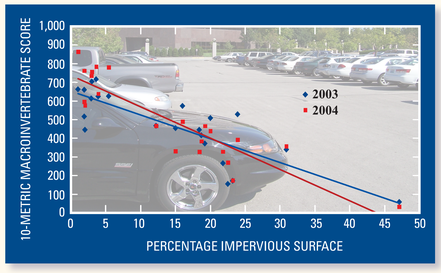
Water quality of all of the primary streams in Johnson County, representing urban and rural basins, was characterized from October 2002 through December 2007 using benthic macroinvertebrate, discrete water, and streambed sediment samples, and continuous water-quality monitoring.

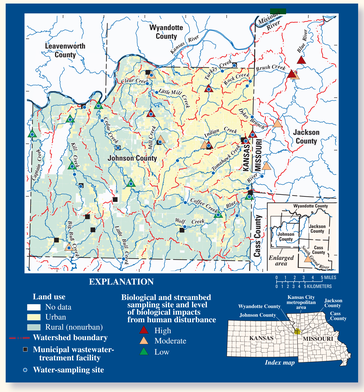
The water-quality information is useful for:

- Defining current conditions and documenting changes.
- Understanding variability in conditions.
- Evaluating effects of urbanization.
- Evaluating conditions relative to water-quality standards and goals.
- Developing effective water-quality management plans.


## Biological Conditions – An Overview of Stream Quality

- Stream sites that were least impacted by human disturbance occurred in rural areas.
- As percent impervious surface (a measure of urbanization) increased, biological quality generally decreased.
- No sites, including a state reference site, met state criteria for full support of aquatic life.



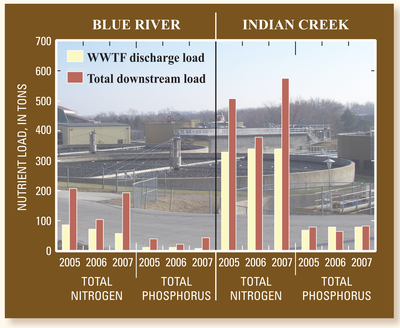




## Suspended Sediment

- Sediment load occurs mostly during the largest storms. At least 90 percent of the sediment transported in the county's five largest watersheds occurred during less than 2 percent of the time.
- Sediment load was much larger (four times) in 2005 compared to 2006, primarily because of 35 percent more precipitation.
- Management practices designed to control sediment during large streamflows can substantially reduce loads of sediment and contaminants such as bacteria and nutrients that often are associated with sediment particles.

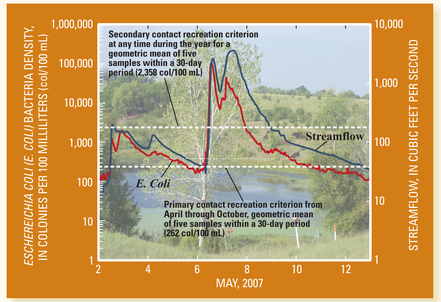
## Nutrients and Dissolved Oxygen

- Wastewater discharges were a primary contributor to downstream nutrient loads.
- Dissolved oxygen (important for aquatic life) was less than the minimum state criterion from 2 to 15 percent of the time in the five major streams during 2004–07. The most urban stream had the lowest concentrations.
- Large nutrient loads can lead to excessive algae growth and low dissolved oxygen conditions that are harmful to aquatic life.



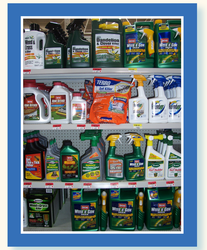

## Indicator Bacteria

- Bacteria in streams primarily originated from stormwater runoff.
- Less than 3 percent of the total estimated bacteria loads originated from wastewater treatment facility discharges.
- Estimated *Escherichia coli (E. coli)* bacteria density was nearly always largest in the most urban stream where the Kansas primary contact criterion was exceeded 65 percent of the time during 2005–06.
- Water-quality conditions of streams often change rapidly during storm runoff.




## Pesticides and Other Organic Compounds

- More than one-half of the total concentration of 54 organic wastewater compounds tested in baseflow samples from 45 stream sites consisted of a musk fragrance (AHTN), caffeine, mosquito repellent (DEET), a detergent surfactant (nonylphenol diethoxylate), and a plasticizer and flame retardant (tris(2-butoxyethyl) phosphate).
- During base flow, urban streams had the largest number of pesticides, and rural streams had the largest total concentrations of pesticides.
- Pesticides and other organic compounds can accumulate in streambed sediment and harm aquatic life. The long-term effects of continuous exposure are unknown.



## Conclusions

- Biological, sediment, nutrient, bacteria, and organic compound data indicate that streams in Johnson County, Kansas have been adversely affected by urbanization.
- Water contaminants including sediment, bacteria, and pesticides (particularly during spring) at urban and rural sites primarily originated from non-point sources during storm runoff.
- Water quality of streams varied according to climate (precipitation and resulting runoff), degree of urbanization, and contribution from wastewater discharges.

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